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FIELD STUDY OF DISPOSED WASTES FROM ADVANCED COAL PROCESS

Quarterly Technical Progress Report
May - July 1986
(Final Report)

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1.0 PROJECT OBJECTIVES

The Department of Energy/Morgantown Energy Technology Center (DOE/METC) has initiated research on the disposal of solid wastes from advanced coal processes. The objective of this research is to develop information to be used by private industry and government agencies for planning waste disposal practices associated with advanced coal processes. To accomplish this objective, DOE has contracted Radian Corporation and the North Dakota Mining and Minerals Resources Research Institute (MMRRI) to monitor a limited number of field disposal tests with select advanced coal process wastes. These field tests will be monitored over a three year period to collect data on the field disposal behavior of these wastes.

There has been considerable research on the characteristics and laboratory leaching behavior of coal wastes -- a lesser amount on wastes from advanced coal processes. However, very little information exists on the field disposal behavior of these wastes. Information on field disposal behavior is needed a) as input to predictive models being developed, b) as input to the development of rule of thumb design guidelines for the disposal of these wastes, and c) as evidence of the behavior of these wastes in the natural environment.

2.0 OBJECTIVES FOR THE SECOND QUARTER CALENDAR YEAR 1986

The project was started in May 1986. Objectives for the second quarter (May through July) were as follows:

- Conduct project kick-off meeting,
- Initiate literature review, and
- Formalize basis for the design of the field tests.

3.0 ACTIVITIES FOR THE REPORTING PERIOD

3.1 Project Kick-off Meeting

The project kick-off meeting was held May 28 at Radian's offices in Austin, Texas. During this meeting Radian and MMRRI presented approaches to the COTR and CO on all aspects of the research project. The presentations included probable approaches in accomplishing the tasks and the advantages/disadvantages of each different approach. This meeting, and the information from the meeting, formed the basis for Task 1.2, Formalize Basis for Test Design.

3.2 Task 1.1 - Literature Review

The initial literature review was conducted. A filing and tracking system for pertinent literature was established. Most of the literature is already available in Radian and MMRRI libraries, however, a review of the open literature was conducted for related research. This review will be updated on a bi-monthly basis through a computer based Selective Dissemination of Information System.

3.3 Task 1.2 - Formalize Basis for Test Design

In this task a discussion of the literature review was prepared. A draft of a technical memorandum presenting the state of knowledge concerning advanced coal process wastes will be delivered to the COTR in August. The memorandum also presents aspects of the test design, including design options and monitoring approaches. The salient parts of the memorandum are summarized below.

Design Options. A number of elements constitute any given field disposal situation. They include waste type, climate, disposal facility type,

interface between waste and soil, soil conditions and ground-water conditions. Each element has a number of options from which to choose a field test design.

A set of criteria were developed to guide the choice of options. One set of criteria concerns how closely a given combination of options represents the expected disposal conditions at future advanced coal processing facilities. This would include criteria that ensure the selection of the most promising process, wastes, and disposal facility type and setting. The second set of criteria concerns the type and usefulness of data that will be generated from a test design. The options selected should provide a maximum amount of information on the phenomena of interest, these phenomena being:

- Leaching of contaminants from the waste,
- Flow of moisture and leachate,
- Transformation of contaminants,
- Attenuation of contaminants from the leachate, and
- Dispersion of contaminants.

For example, there are a number of advanced coal processes and associated wastes. However, only a few processes will have the bulk of the impact on coal use in the next 10 to 20 years. And, for these processes, there are a select set of wastes that are representative of the processes and can yield data on the phenomena of interest during this project. The criteria favor the selection of these few wastes for use in the field tests.

The following paragraphs present the design options that have been identified to date. The options which best satisfy the two criteria just mentioned, i.e., representativeness and providing data on the phenomena of interest, will constitute the generic test design.

Waste type. Based on experience in both existing and emerging coal conversion technologies, Radian has determined that the two

technology areas which will have the greatest impact on increasing coal utilization will be fluidized bed combustion to generate steam and integrated gasification combined cycle power generation. Advanced coal cleaning, advanced flue gas desulfurization, hot gas clean-up and coal slurries will have a positive effect on increasing coal utilization, but to a lesser degree. The wastes generated by these processes will be selected to provide a variety of physical and chemical properties. The properties that will have the greatest affect on the phenomena of interest are permeability, leachable trace metals, leachable trace organics, leachable total dissolved solids (i.e., sulfate) and extreme pH in leachate.

Climate. The continental United States can be divided into 12 regions, based on temperature, precipitation, wind, pressure and relative humidity patterns. Water balance (excess of precipitation over evaporation) and temperature are the two most important climatic variables which may affect test design. By considering these two variables, the twelve regions are reduced to seven climatic options. These climatic options will be used in selecting test sites that are representative of the potential future sites for coal conversion plants.

Disposal facility type. Advanced coal processing wastes are expected to use the same types of waste disposal facilities as coal combustion industries use. These facility options are landfills, mines and surface impoundments. Accordingly, the design of field tests will consider these three facility types.

Interface between waste and soil. An important aspect of the design of advanced coal waste management facilities is the nature of the system which separates the waste mass from the surrounding soils. In an engineered disposal system this interface may include liners and leachate collection systems. However, it is imperative in the

design of this project that information on the interactions between the waste and surrounding environment be collected. Therefore, controls, such as liners, between the waste and the environment will not be designed into the tests.?etall?

follow up what this means.

Soil conditions. Within most sites the area immediately in contact with the waste will consist of unconsolidated soils. Where these soils are unsaturated, it is referred to as the vadose zone. The soils in the vadose zone can be categorized by their affect on the phenomena of interest. These categories refer to thickness of the vadose zone, hydraulic properties of the vadose zone, clay content of the soils, chemical makeup of the soils and organic content of the soils. The characteristics of the vadose zone will be highly variable even within a region.

Ground-water conditions. The ground water is that zone of the substrate around a disposal facility that is saturated with water. This zone is the recipient of infiltrating leachate and often the principle environmental target for impacts of waste disposal. The properties of the ground water zone which are considered most important to design of the tests are quality of the ground water, flow rates, depth to aquiclude and size of aquifer. These parameters are important because they affect the rate at which contamination from a disposal facility will spread in the aquifer and the damage which contamination of the aquifer would cause.

Monitoring Approach. The objective of monitoring the field tests will be to obtain information on the phenomena of interest. Monitoring of the leachate in the field tests can be accomplished by in situ techniques, such as lysimeters, or by coring of the waste followed by analysis of the media and/or leachate. The coring method can also be used to gather information about the waste and/or soil. Flow of moisture through the waste and vadose zone will be accomplished using in situ techniques such as neutron probe access tubes,

need a picture

tensiometers or resistance blocks. Transformations in the leachate due to chemical reactions, biological activity or attenuation by the soils will be monitored in a manner similar to the waste leachate monitoring, i.e., collection of the pore water followed by chemical analysis of the constituents in the water. Finally, the monitoring of the zone of saturation (ground water) will be accomplished by the collection of water and soil samples. Water samples from the zone of saturation will be collected using monitoring wells and soil samples will be collected using the coring techniques used for the waste and soil sampling.

Other Aspects of Test Design. The major technical criteria in designing the field tests, as stated above, are 1) how closely the field tests represent the range of disposal conditions anticipated for the wastes, and 2) the amount of information the design will provide on the phenomena of interest. However, other considerations which will be factored in to the design of the tests include the ability to obtain permits for the test site, the ability to obtain access to the site, potential risks to the environment from conducting the tests, and integration of this field project with other research in the area.

What about the relationship between FT and full scale / FT and lab tests? Gordon has mentioned this.

4.0 PROBLEMS ENCOUNTERED

No problems were encountered.

5.0 ACTIVITIES PLANNED FOR THE NEXT QUARTER

The following activities are planned for the period of July through September of 1986:

- The literature review will be completed and documented as part of the technical memorandum on Task 1.2, Formalize Basis for Test Design.
- The draft technical memorandum on the basis for the test design will be delivered to the COTR August 29, 1986. This document

will present the state of knowledge on aspects of advanced coal process wastes that will affect the design of field tests. It will also present the basis for designing the field tests.

- Work on Task 1.3, Design Options, will be largely completed during this period. In this task, generic test designs will be selected.

- The draft Design Manual will be prepared for delivery to the COTR on October 7, 1986.